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JOURNAL

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ELISHA MITCHELL SCIENTIFIC SOCIETY.

VOL. XXI DECEMBER, 1905 NO. 4

FOOD ADULTERATION.

BY ALVIN S. WHEELER

Associate Professor of Chemistry, University of North Carolina.

The human body is a chemical laboratory in which fires are kept up at night as well as by day. In it the most complicated chemical reactions are carried out, many of which man can neither reproduce nor understand. Some of the complex substances can be made by man at very high temperatures, but the body needs only its own moderate temperature. Here we come face to face with one of the wonders of nature. The food which we eat constitutes the fuel which feeds the fires, and if this is not what it purports to be, then abnormal substances are produced, the machine is thrown out of gear—in short, we are sick. The question of pure food is a vital one. That we do not always get it is absolutely certain. To quote a recent writer: "In these days of butter not traceable to the cow, of wine innocent of the grape, of beer estranged from hops and malt, of coffee-berries made in a mold and not grown on a bush, of honey not made in a beehive but in a factory, and a thousand and one audacious frauds, we consume one hundred million dollars' worth of fraudulently prepared food

a year. Fraud has been officially detected in more than three thousand samples of food. From the cheapest and most ordinary article of diet, such as French sardines (caught off the coast of Maine) and canned salmon (with apologies to the swordfish) to such costly delicacies as Russian caviare (collected in Delaware Bay) and imported Lucca oil (from the cotton fields of Georgia), there is imposition." But Americans do not object to this very seriously, perhaps on account of a trait of character portrayed by Dr. Wiley before the Franklin Institute. He spoke as follows: "Barnum made a colossal fortune by acting on the principle that Americans liked to be humbugged. There is something soothingly seductive in being led to the circus by lurid posters showing unattainable attitudes of impossible monsters. This attractiveness is increased by the knowledge that, like the limited express, it implies an extra charge. Were the feats of legerdemain of the mystic Herman actual performances of supernatural powers, they would lose for us half of their charm. To be cheated, fooled, bamboozled, cajoled, deceived, pettifogged, demagogued, hypnotized, manicured and chiropodized are privileges dear to us all. Woe be to that paternalism in government which shall attempt to deprive us of these inalienable rights."

Notwithstanding that food adulteration has caused a good deal of discussion and legislation throughout our land, there is considerable suspicion that it is much ado about nothing. Sooner or later the public will realize the tremendous extent of the fraudulent practices which are in operation. Not only is there danger to the life and health of the consumer, but honest industry is seriously injured. For many years a Pure Food Bill has been before Congress, but so far it has failed to pass. Most of the states, however, have laws which are applicable within their borders. These laws are based upon the English Food and Drug Act, which became a law in 1875. Last November Secretary Wilson, of the Department of Agriculture, approved and proclaimed the Official Food Standards, which had just been formulated by the United States Food

Standard Commission and a committee of the National Association of Pure Food Commissions. It is no simple matter to say what the standard of any particular food shall be, and this recent action only partially covers the ground. The standards consist of definitions and chemical limits, and embrace meat and its products, milk and its products, sugar and its related substances, spices, cocoa and cocoa products. It is hoped that this work will be completed within two years.

The adulteration of food is not a sin of modern times. In London, eighty-five years ago, grocers sold tea made of thorn leaves, dried on copper and colored with logwood and verdigris. Milk was largely made of chalk and water, and sugar was mixed with sand. Only a few years ago a member of my family while in London returned to a grocer some sugar which only partly dissolved in water. The grocer appeared horrified and made the exchange with remarkable rapidity. In the United States the granulated white sugar is as pure as the manufacturer can make it.

The demand for pure food becomes more and more insistent each year, as realization grows of the far-reaching extent of adulteration. A recent bulletin of the North Carolina Board of health reveals how extensively food is now adulterated. The report says that 29 per cent of the vinegar examined was untrue to name; 33 per cent. of the honey was adulterated; 37.5 per cent. of the jellies and jams, and every single sample of apple butter, catsup, and sauces. As I have already said, most of the States have adopted pure food laws, and an immense amount of good has been accomplished through them. Each State has a Food Commission, which keeps a watchful eye upon every variety of food sold within the boundaries of the State. Samples are bought in the open market and carefully analyzed by the chemist of the Commission. Where adulteration is found the violator is prosecuted, and prosecutions are usually successful. In Ohio, during 1901, there were 252 prosecutions. The jury disagreed in only seven cases and there were only nine acquittals. It is interesting

also to note the decrease in adulteration. In Massachusetts in 1883 the percentage of samples of adulterated milk was 83. This fell to 28 in 1900. The percentage of adulterations of foods dropped from 31 per cent. to 14.

Milk is most liable to fraud of all the different kinds of food, because the chief adulterant is water, which costs nothing. In Massachusetts three-fifths of the entire appropriation is devoted to the inspection of milk and its allied products, butter and cheese. In the city we are more apt to be confronted with blue milk than in the country. The law in most States requires the presence of twelve parts of solid matter, since the natural product of the cow does not contain less than this, though it may contain much more. The cream rises in a cow's udder the same as if in a milk-pan, and, unless the cow has violently exercised just before milking, the first milk is less rich in butter fat, and this, by some, is sold to the consumer. The last of the milk, called the strippings, is nearly pure cream. The milkman is apt to keep this for his own private buttermaking.

Owing to the fact that milk is such a splendid medium for the growth of all kinds of bacteria, which bring about its decomposition, it is an exceedingly common practice for the milk dealer to add some antiseptic, especially formaldehyde, so that it will keep in hot weather and may be transported long distances. On account of the physiological action of formaldehyde it is a menace to the health and its use in milk should be condemned. But this form of adulteration is dangerous from another standpoint: it becomes a substitute for cleanliness and sanitary precautions, which are so essential to the healthfulness of milk. The requirement of cleanliness is appreciated by the modern progressive dairy, which is a model of purity.

In Connecticut the collection of milk samples is made by agents, who are provided with bicycles carrying in the frame a case containing eighteen cans of a half-pint capacity each. The construction is such that one can may be removed with-

out disturbing the others. Between four and seven o'clock in the morning the agent rides from street to street and buys a pint of milk from every milkman whom he meets, without making known the object of his errand. He notes the name of the milkman or of his dairy given on the wagon.

Eggs, of course, cannot be adulterated, but they may be of varying quality, and now substitutes for them are being manufactured. The reasons for this are that eggs are high priced in winter, while in summer they deteriorate too rapidly. On the Boston market one has the privilege of buying eggs of different ages—"strictly fresh eggs," "fresh eggs," and "eggs." An egg may be preserved by evaporating its contents down to the solid state. By maintaining a low temperature, the water, which is the largest constituent, is driven off. This preparation is called La Mont's crystallized eggs. It is an important product, for in one year alone 100,000 pounds, equivalent to 4,800,000 eggs, were shipped to South African miners. In New York they are now manufacturing an egg substitute, called "ovine." It is said to "take the place of fresh eggs in baking." Analysis, however, shows that it resembles the white of an egg in composition, and not the whole egg.

Coffee offers a good field for the fraudulent operations of the manipulator. The coffee berry is imitated not only in the green state, but also in the roasted condition. There are more than six firms in this country regularly engaged in the manufacture of coffee-bean making machinery. Bogus berries are ground out by the ton, and they are better looking than those that grow on the bush. A paste is made of chicory, starch, pea meal, caramel, and molasses, molded into the proper shape and dried. The pure-food laws have had a very beneficial influence upon coffee adulteration. In one State the percentage of adulterated samples fell in two years from 63 to 25. The adulterants of ground coffee are peas, chicory, wheat rye, and bean hulls. So-called coffee compoundr are mixtures of coffee with other substances, such as cereals. Sometimes

the packages are properly labeled, and again they are not.

Another indispensable beverage is tea. The extent of its use is indicated by the statement that in a recent year ninety-four million pounds were imported into the United States. Tea is adulterated with soapstone, gypsum, iron dust, and sand; also with lie tea, the trade name of a mixture made up of tea dust and other matters made into lumps with starch paste and colored. Tea is also mixed with exhausted tea leaves and leaves of the beech, willow, elm, rose, and wistaria. Finally, all of the green tea and a good deal of the black tea is faced or coated to impart a gloss and an attractive color. Prussian blue, indigo, and soapstone are used for green teas, and plumbago or black lead for black teas.

Cocoa and chocolate are making remarkable headway as beverages. Coffee and tea have been objected to on hygienic grounds, and substitutes are being extensively used. Cocoa is more nourishing than any other beverage, and perhaps as sustaining. Cocoa beans are reddish brown in color and resemble lima beans in shape and size. They are first roasted, a chemical change occuring which developes a very desirable flavor. They are next crushed by machinery to separate them from the shells. The broken cotyledons, free from shells, are known as cocoa nibs. These are ground, and the heat of grinding melts the fat which makes up one-half of their weight, and the ground product runs out as a thin paste. This is allowed to cool in molds, and constitutes our unsweetened chocolate. Cocoa is prepared by removing a part of the fat by pressure and reducing the residue to a powder. Cocoa is made inferior by grinding the beans with the shells on. It is adulterated by adding extra shells as well as wheat flour, cornstarch, and sugar, and this is a common practice.

Beneath the beautiful exterior of the soda fountain sit enthroned a host of frauds. We complacently enjoy the beautifully colored drinks with the idea that they are made of natural fruit juices, such as strawberry, cherry, raspberry, and many more. Some dispensers use the real fruit, but very com-

monly the syrup is made by dissolving granulated sugar in water colored and flavored with substances made in a factory and, finally, in some cases, soap bark is added in order to produce a fine foam. The variety of drinks is very extensive, one wholesale house alone offering an assortment of three-hundred and thirty-three syrups. The artificial extracts made to imitate strawberry, raspberry, and certain other fruit juices are especially obnoxious and give rise to indigestion. Coal-tar dyes are used for coloring purposes, especially for the brilliantly colored drinks seen at State fairs and summer resorts. In Minnesota recently it was discovered that an alleged sweet-apple cider came "fresh from a cider-press" to which the juice was delivered by an underground pipe.

The most palatable and costly sugar is maple sugar. It is an important product, about five million pounds annually coming mostly from Vermont, New Hampshire and Ohio. The great metropolis of the West is also noted for its prodution. A small quantity of the pure article serves to produce large amounts of "maple syrup." To such an extreme is this carried that there is not left even a smell of the real maple. Adultertion is extraordinarily extensive, and it has invaded the maple woods. The reasons are succinctly stated by the Illinois Food Commissioner as follows: "First—It is so easy any one can do it. Second—It is profitable. Third—Adulteration being common, the manufacturer is compelled to follow suit in order to compete in price. Fifth—The production of maple syrup is less than the demand. Sixth—The undoubted demand for a syrup with a slight maple flavor at a less price than the pure product commands. Seventh—The questionable fact that certain varieties of maple (Canada, North Minnesota)yield a syrup of stronger flavor than consumers demand." The adulterants or substitutes for the maple sugar are cane sugar, beet sugar, glucose, and dextrin. To produce the maple flavor extracts of walnuts, butternuts, and corn-cobs are used.

A pure fruit jelly is made entirely from the fruit juice with. the addition of cane sugar. The adulterants are numerous

The jellying quality may be imparted by starch paste, gelatin, or agar-agar, a gelatinous material obtained from sea-weed. These, of course, have no taste, but by adding a coloring matter and some flavoring extract we have at once currant jelly, grape jelly, or any kind whatsoever. Glucose is much used for sweetening purposes, although it is less sweet than cane sugar, the ratio of sweetness being about three to five. In one year the Connecticut station found twenty pure jellies and forty-three adulterated, the first being home products, while the adulterated were factory products. Jams also are not always what they seem to be. A sample of strawberry jam recently analyzed in Nebraska was found to consist mostly of pumpkin, tinted with coal-tar dyes, preserved in benzoin, with grass seed thrown in to make the jam look like the real thing.

Honey in the comb probably cannot be adulterated except by the bee itself, which seems to have a monopoly on capping the cells. That the inventive American has made many attempts to produce a machine which would do this work there can be no doubt. Strained honey is readily adulterated, glucose being the usual adulterant. Sometimes only sufficient real honey is added to impart a slight honey flavor. A glass jar of glucose with pieces of honeycomb floating in the liquid makes a beautiful deception and a very profitable one.

Spices afford a very attractive field for the sophisticator. Allspice has been found in some cases to contain as much as 85 per cent. wheat and nut shells. Cayenne is adulterated with corn, wheat, ginger, and a red aniline dye. Cloves may contain wheat, sawdust, charcoal, and factory sweepings. Ginger is adulterated with wheat, rice, and pepper. Mustard is liable to contain mustard hulls, corn, wheat, and rice sometimes to the extent of 90 per cent. Pepper is adulterated with wheat, ginger, pepper shells, olive stones, and buckwheat,

The labeling of food products is a matter of considerable importance, because it is from the label that we usually get our ideas of the character of the goods. Labels are wholly deceptive. Such words as "high quality," "high grade," "ex-

cellent quality," "pure," and "unadulterated," are often found attached to articles of the most worthless character. Various devices are employed to lead the unwary astray. Here is a label:

LEMON EXTRACT

Alcohol, 415. Aqua, 450. Oil Lemon, 15.

The resort to the Latin word is a fraud of low order. The extract actually contained more water, less alcohol, and no oil of lemon whatever. On a box of powdered borax put out by a New York house was found the following caution: "Avoid the many spurious imitations of our borax with which the market is flooded, and which can only do harm to those who use them. See that our trade mark is on every package." The chemical examination of this borax showed that every package was seriously adulterated with bicarbonate of soda.

Again on a package of coffee, the statement "Made of pure coffee and cereals" is placed perpendicularly, and the instruction to "Open this end" placed at the opposite end.

The food laboratory in the Bureau of Chemistry, United States Department of Agriculture, is now engaged in investigations of the highest importance. Under Dr. Wiley a squad of men take their meals at the Bureau's laboratory, the food being doctored with borax, salicylic acid, and other substances which are said to be deleterious to health. The experiments are extremely interesting, and the results promise to be important.

In conclusion it may be said that all adulterations are not harmful; in fact, many are actually wholesome. A watchful eye is required to detect the serious abuses, which are all too common, and it is necessary to distinguish between the harmless and harmful frauds. The press is prone to exaggeration —a practice vividly portrayed by Bob Burdette in the following poem, entitled "A Victim of Delusion:"

Placid I am, content, serene;
I take my slab of gypsum bread,

And chunks of oleomargarine
Upon its tasteless sides I spread,

The egg I eat was never laid
By any cackling feathered hen;
But from the Lord knows what 'tis made
In Newark by unfeathered men.

I wash my simple breakfast down
With fragrant chicory so cheap;
Or with the best black tea in town—
Dried willow-leaves—I calmly sleep.

But if from man's vile arts I flee,
And drink pure water from the pump,
I gulp down infusoriæ
And hideous rotatoriæ
And wriggling polygastricæ
And slimy diatomaceæ
And hard-shelled orphryocercinæ
And double-barrelled kolpodæ
Non-loricated ambrœilæ
And various animalculæ
Of middle, high and low degree;
For nature just beats all creation
In multiplied adulteration.

[By permission of the Outlook Company.]

NOTES ON THE SCUTELLATION OF THE RED KING SNAKE, OPHIBOLUS DOLIATUS COCCINEUS, SCHLEGEL.

C. S. BRIMLEY.

"Body color scarlet, completely encircled by pairs of black rings, with interspaced white in the young, yellow in the adults: no lateral spots, top of head red, with the first black ring crossing the parietals. The pattern is formed by the obliteration of the lateral portion of the black borders of dorsal spots, and the extension of their transverse portion entirely around the body. The lateral spots have disappeared" (From "A Review of the Genera and species of North American Snakes, North of Mexico," by A. E. Brown, Proc. Acad. Nat. Sci, Phila, Jan. 1901). According to Brown the normal scutellation would seem to be 21 rows of scales, loreal present, one temporal in the first row, the rows of scales occasionally varying to 19, and the loreal sometimes absent, this extreme form being the Osceola elapsoidea *B. and G.*

Cope treats the two forms as a distinct species, and gives the scutellation as loreal present, two temporals in first row, and rows of scales 21 for *coccineus*, and loreal absent, one temporal in first row, row of scales 17 or 19 for *elapsoidea.* (Crocodilians, Lizards and Snakes of North America, by E.D. Cope, Report of U S. Nat. Museum, 1898.)

My experience is that the normal formula is, scales in 19 rows, occasionally 17 or 21, one temporal in first row, occasionally two, and loreal usually present, but sometimes absent on one or both sides.

The specimens that I have examined with reference to some or all of these points are

A. Specimens from Bay St. Louis, Miss.

No.	Length.	Loreals	Temporals	Scales	Examined
1	21 inches	1–1	1–1	19	Mch. 11.'01
2	21 "	1–1	1–1	19	" " "
3	8 "	0–0	2–2	19	" " "
4	10 "	1–1	1–1	19	" " "
5	15 "	1–1	1–1	19	" 19 "
6	12 "	1–1	1–1	19	" 25 "
8	240 mm	1–1	1–1		alcoholic 3607
9		1–1	2–1	19	" 3654
10		1–1	2–?		" 3055
11		1–1	1–1	19	" 3058
12		1–1	1–1	19	" 3045
14		1–1	1–1	19	" 3057
15		1–1	1–1	19	" 3056
16		0–0	1–1	19	" 3044

B. Specimens from Raleigh, N. C.

7		0–0	1–1	19	Apl. 26,'01
13		1–.	2–2	21	alcoholic 3059
19		0–0			May 10'05
20	180 mm	1–1		19	alcoholic 5524
21	150 "	1–?	1–1	19	" 5523
22	450 "	0–?	2–1	21	" 3682
23	240 "	0–0	0–0	19	" 3683

C. Specimens from Florida.

18 from Orlando.	0–0	1–1	17	" 2330
17 from Tarpon Sp	1–1	1–1	17	" 2488

NOTES ON THE ABOVE SPECIMENS.

No. 2 has the nuchal yellow collar divided in the center by a longitudinal bar of black.

10 has both red and and white rings more or less interupted on the belly by black.

13 has the adjacent black rings uniting on the belly, enclosing the red dorsal spots.

20 has the white rings mainly interrupted more or less on the belly by black blotches, while the red rings are uninterrupted.

21 is typical coccineus, in color, but has the loreal reduced on one side to a small triangular plate at the junction of the prefontal, nasal, and 1st and 2nd upper labials.

22 is nearly typical cocineus, but has black spots on the belly opposite the white rings. Several of the head plates peculiar. The loreal is absent on one side and represented on the other by a triangular plate cut off front of prefontal and extending to the labials.

23 has red spots closed by a partially divided black tract on middle line of belly. Black spots on belly opposite the white rings are present on latter half of belly only. Sixth upper lacial on each side reaches to the parietals and suppresses the temporals.

SUMMARY. The Mississippi specimens all have 19 rows of scales, except two not examined for that point, twelve of them have the loreal present on both sides of the head, and two of them have it absent on both sides: eleven have one temporal in the front row on both sides, one has two temporals on both sides, one has one temporal on one side and two on the other, and the last has two temporals on one side and the scutellation could not be made out on the other.

Of the Raleigh specimens four have 19 rows of scales, and two have 21, while a seventh was not examined for that point. Two have a loreal on both sides, three have the loreal absent on both sides, while of the remaining two, one has loreal present on one side and represented by an abnormal plate on the other, and the other has loreal absent on one side and represented by an abnormal plate on the other. As to the temporals two specimens have one in first row on each side

and two more have two on each side, a fifth has two on one side and one on the other, while the sixth has the temporals completely absent. The seventh was not examined on that point.

The obvious conclusions are that the normal scutellation is 19 rows of scales, loreal present, and one temporal present in the first row. The most curious feature is the large percentage of Releigh specimens with the loreal absent or abnormal on one or both sides, a feature we would naturally expect in the more southern specimens rather than in the northernmost of those examined.

NOTES ON THE FOOD AND FEEDING HABITS OF SOME AMERICAN REPTILES.

C. S. BRIMLEY.

The following notes are from personal observations made during the past ten or twelve years on various reptiles, both wild and in captivity.

Taking the snakes first, their method of swallowing their prey deserves attention, and to understand this it must be remembered that both the upper and lower jaws and the teeth-bearing bones of the palate are united by ligaments only, thus rendering the mouth capable of very great dilation. Furthermore, any ordinary harmless snake has four rows of sharp backwards pointing teeth in the upper jaw and two rows in the lower.

Now, when a colubrine snake, a Spreading Adder (*Heterodon platyrhinus*) for instance, seizes its prey, in this species always a toad, it at once commences, so soon as it has a good hold, to work one side of the jaws forward over the animal with a chewing motion; then when it has worked that side as far as possible it takes a firm hold with that side and works the other side forward over the animal alternately until it is well within the mouth, when it is pushed down into the stomach by the muscular contraction of the body; the snake in fact literally glides over its prey, after it is once safely inside, often pushing it down by crawling forward with its side pressed against some hard object.

In the case of *Coluber obsoletus* or any other of the chicken snakes swallowing a hen's egg, an apparently impossible feat when one sees the snake and egg side by side, the modus ope-

randi is exactly the same, except that the snake has to get the egg in a position where he can push his mouth over it without it rolling away, in the corner of a box for instance. The egg so far as I can make out passes into the snake's stomach whole and unbroken and the shell being dissolved by the digestive fluids, its contents are released and digested.

Those harmless snakes which have but little constricting power, such as the various species of Water Snake, the Garter Snakes, Green Snake, and Spreading Adder, simply catch their prey and swallow it alive and whole without further dallying. The Snakes of the genera Ophibolus (Lampropeltis,) Pityophis, Coluber (Callopeltis,) Bascanion and Spilotes, commonly known as King Snakes, Bull Snakes, Chicken Snakes, Black Snakes, Coachwhips, and Gopher Snakes have however very considerable constricting power as may be easily proved by allowing a good sized specimen of any of these genera to coil itself round ones wrist, but to what extent they habitually kill their prey by this means I do not know. The common black King Snake with white rings whose food consists of rats, mice and other snakes kills the latter in its coils before swallowing them, but how it treats the former I do not know. On one occasion I had placed a King Snake, possibly some 18 inches or 2 feet long in a box with a number of other snakes all considerably larger than itself, almost immediately it glided up to a large Black Snake and seizing it by the head wrapped itself in a tight spiral coil round the forepart of the latter's body. The Black snake however thrashed about so violently that the King had to let go, and when the latter again attempted to seize him the Black Snake struck him on the head which cooled off his ardor and there was no further trouble between them. On another occasion I placed a large King Snake in a box with a smaller Black Snake, and the former seized the latter by the head and crushed the life out of him in his coils, but releasing the Black Snake's body little by little as he swallowed it. I once saw a Chicken Snake, I think it was the striped southern species *Coluber quadrivittatus*, kill a young fledgling bird

which I had placed in the same box with it crushing it to death in a U-shaped fold of the snake's body. These snakes all swallow their food in precisely the same way as the Spreading Adder, which is the usual method with snakes. The constricting power of the genera Ophibolus and Coluber is much greater than those of the genus Bascanion (Black Snakes and Coachwhips).

Of the amount of food consumed by snakes I have four records. The first is that of a poisonous snake, a Copperhead (*Ancistroden contortrix*) an average sized adult, which grew fat and improved greatly on the following diet: 1897, Aug 7, small bird; Aug 12, ditto; Aug 19, ditto; Aug 25, ditto; Aug 30, 1 mouse, Sep 10, 14, and 19, one small Cotton Rat on each date. In 44 days it ate nine times, never eating more than one small bird or animal on any one day, though more than that number were sometimes offered it. All the specimens were dead. The snake improved in girth and color and some chafed places on its neck entirely disappeared.

The second record is that of a 33 inch Rat Snake or Spotted Racer (*Coluber guttatus*) which did well on the following rations:—1897, July 29, one bat; Aug. 7, one small bird; Aug. 10, 12, 17, and 19, one bat on each date; Aug. 23, one small bird; Aug. 30, one bat; Sep. 14, one mouse; Sep. 20, one shrew In 54 days it ate ten times, in 31 days it ate seven times.

The third and fourth records are of the Spreading Adders, one of which ate ten toads from Aug 6 to Sep 11, 1897 (ten toads in 86 days,) and another twelve toads from Aug 6 to Sep 9, 1897 (twelve toads in 34 days).

The food of the various species of snake that have come under my notice is as follows, so far as my observations go,—

Spreading Adder(*Heterodon Platyrhinus*): toads (Bufo) only.

Water Snake (*Natrix sipedon*): fish, toads.

Garter Snakes (*Eutaenia sirtalis*): toads.

Ribbon Snake (*Eutaenia saurita*): small frogs, small salamanders.

Chicken Snakes (*Coluber obsoletus, C. o., confinis, C. o.,*

lindheimeri, C. quadrivittatus): rats, mice, small birds up to size of quail, young birds, bird's eggs, hen's eggs.

The Bull Snakes (*Pityophis sayi and P. melanoleucus*) same food as the Colubers.

Spotted Racer (*Coluber guttatus*) has not been observed to eat hen's eggs, but otherwise its food seems to be much the same as the other Colubers, although I think it shows a much greater preference for rats and mice: and the same remarks apply so far as my experience goes, also to the Black Snake (*Bascanian constrictor*) and the Coachwhip (*Bascanian flagellum*).

King Snake (*Ophibolus getulus*): rats, mice and other snakes.

Brown King Snake (*Ophibolus rhomboamaculatus*): rats, mice and lizards.

Red King Snake (*Ophibolus coccineus*): lizards, (Eumeces and Liolepisma).

Green Snake (*Cyclophis aestivus*): large insects such as larval katydids and the caterpillars of the Silver-spotted Skipper.

Brown Snake (*Haldea striatula*): earthworms.

With regard to the food of lizards, I cannot say much. The smaller species however eat insects of various kinds, the common rusty Fence Lizard (*Sceloporus undulatus*), and the Green Lizard (*Anolis principalis*), commonly though erroneously known as "Chameleon," having been observed in confinement to eat house flies, young grasshoppers, and small butterflies, while the Bluetailed Lizard (*Eumeces fasciatus*) commonly known as "Scorpion" in the South, has been observed to eat house flies, butterflies, small carabid beetles, earthworms, cockroaches and large, smooth caterpillars, but bright colored butterflies were not liked. The so-called Glass or Joint Snake (*Ophisaurus ventralis*) has been observed to eat Katydids, large Bird Grasshopper (*Schistocera americanum*) and large butterflies such as the swallowtails. The other legless lizard of the eastern United States, the curious Flor-

ida Blindworm (*Rhineura floridana*) which superficially looks more like an earthworm than a lizard, apparently eats earthworms, as in 1900 I kept some for several months and used to put earthworms in the box of earth in which they were kept, and the said worms uniformly disappeared without leaving any trace behind.

Only one other lizard has come under my notice in captivity, viz.: the big Gila Monster (*Heloderna suspectum*) of Arizona and this in captivity seems to confine itself mainly, if not entirely to hens' eggs, which when broken on a plate are lapped up by its broad fleshy tongue. My notes on this species are as follows:—1898, July 9, one large one received, drank water; July 11, ate 3 eggs; July 12, ate two; ate nothing from July 13, when he ate one egg, till July 22, when he ate another, not in the meanwhile eating eggs when offered to him. From July 23 to Oct 25 he ate 25 eggs, eating one every three or four days and fattened on the diet. 1899, three Heloderma received May 2, sent off May 9, ate 17 eggs in 8 days. 1899, three more received May 23, sent off May 30, ate 21 eggs in 8 days.

The Testudinata, of which the different species are indiscriminately known as turtles, tortoises, and terrapines the last name being in the South applied to nearly all species except the Snapping Turtle, comprise both omnivorous, carnivorous, and herbivorous species.

The Gopher of Florida (*Xerobates polohemus*) is a good example of the first group, feeding only on succulent plants of various kinds, those I had showing most partiality to nutgrass, although they would also eat corn leaves, zinnia leaves and stems, sowthistles (Sonchus) and also apple peel and pieces of apple. Several of the aquatic species are also mainly herbivorous, especially the Painted Turtle, *Chrysemys picta*, which in 1900 ate greedily of cabbage leaves, although they also have been observed to eat raw flesh, chicken offal, corn bread, pieces of watermelon and canteloupe. They usually drag their food into the water and eat it with the head under

water. On July 16, 1900, however, I saw one eating a piece of canteloupe on land without taking it into the water. *Pseudemys concinna*, the large smooth terrapin of our rivers, is also apparently herbivorous, at least I have never detected one in the act of eating flesh. Our other species of Pseudemys, however, the Rough Terrapin (*Pseudemys scripta*) is an omnivorous feeder eating raw flesh, ripe fruit, and the leaves of succulent plants. Like the two preceding it eats its food, mainly at least, under water. The terrapins of the genus Chelopus seem to be more omnivorous than Chrysemys or rather to show a less decided preference for vegetable food. The Speckled Terrapin (*Chelopus guttutus*) has been observed to eat apple, pieces of watermelon, sonchus leaves, dead snakes, fish scraps, etc, usually taking its food into the water to eat it; the other two species of the genus, however, (*Chelopus insculptus* and *C. muhlenbergii*) seem tc eat their food mainly on land, but are however more terrestrial than *C. guttatus* which is in its turn less aquatic than *Chrysemys picta*.

The Box Tortoises or Highland Terrapins of the genus Terrapene (Cistudo) which are terrestrial and not aquatic have been seen to eat raw flesh, dead birds, ripe and unripe fruit such as apple, tomato, watermelon, canteloupe, plum and persimmons and also occasionally the leaves of succulent plants. June bugs are also eaten during the period of their abundance. Their usual method of eating is to stretch the head forward towards their food, seize a piece in the jaws, and then jerk or pull the head backward so as to tear or cut the piece away, the forefeet being usually braced against the food or placed on it, while the portion to be swallowed is torn away. The morsel of food is then crushed sufficiently by the masticating surfaces of the jaws (turtles have no teeth) and swallowed. There is no difference so far as I have been able to observe in the food of the different species of Terrapene, and I have had opportunities for observing *T. carolina*, *T. major*, *T. triunguis*, *T. ornata*, and *T. bauri*.

The Mud Turtle (*Kinosternon pennsylvanicum*) is apparently

like the rest of its family carnivorous, never having been observed by me to eat vegetable food. This species and the others of the same genus are the only turtles that cannot support themselves in deep water without something to rest on, and if one is placed in a tub of water where it cannot support itself on something so as to get its head out of the water, will soon become exhausted from its struggles to reach the surface and drown. All our other genera of turtles both aquatic and terrestrial, including the nearly related Aromochelys which by the way is thoroughly aquatic, float without any difficulty whatever.

Of our other species of Testudinata I have no observations to record except that a Snapping Turtle in the posession of the State Museum used to eat live toads, dragging them under water to swallow them.

THE SOUTHERN APPALACHIAN FOREST RESERVE.

BY JOSEPH HYDE PRATT.

The forest wealth of North Carolina and Tennessee makes the establishment of a Southern Appalachian Forest Reserve of very great interest to these States; but as these forests affect industries throughout all of the Southern States, and thus affect the industries of the entire country, the establishment of this Forest Reserve is a matter also of national interest and concern. One hundred years ago there was little or no attention given in this country to the method or means by which its forests were cut away; that is, whether they were cut for lumber or ruthlessly destroyed in the clearing of land for agricultural purposes. There was no thought paid to the prevention of forest fires because they were harmful to the forests themselves; and no thought whatever was given to the influence that forests exert on the flow of streams and rivers. At that time there seemed to be a superabundance of lumber for all purposes, the wasteful destruction of which could not then be felt. Forest fires were not considered as doing any particular harm as long as they did not come too near the habitations of men. The streams and rivers always contained plenty of water and for a quarter of a century not enough land was cleared of their forests to demonstrate the effect their removal had upon the water supply.

At the beginning of the 20th century, however, there has been a decided change in the views and ideas regarding the value to a country of its forest resources. Thus, our leading

statesmen and our citizens realize and appreciate not only the commercial value of the perpetuation of our forests, but also the vast influence that these forests exert in the preservation of the water supply of the country. Perhaps their most noticeable influence is in mountainous and hilly countries, which, when covered with abundant forests, prevent the soil from being washed away and by the decay of their leaves form a loam which prevents the waters from running off the surface too rapidly. It is these forest-covered mountains that are extremely valuable because of the effect they have upon water supply and water powers.

By the removal of the forests there is no longer a protection for the soil on the slopes of the mountains and hills except that produced artificially in the form of ditches, etc. There is no longer a layer or bed of leaves to act as an absorbent for the water and a preventive to its evaporation and it runs off for the most part as fast as it falls, causing high freshets and floods and periods of extreme low water; causing the streams and rivers to be higher at times of floods but very much lower the greater part of the time than they were before the removal of these forests. This is well illustrated at the present time in many parts of eastern United States where many of the rivers are not navigable to the extent that they formerly were and many of them are a constant expense to the government in keeping them open to navigation due to low water. While a great deal of harm has already been done in this way, a still greater harm will be done if the remaining forests are not protected. It is not only the navigation of the streams and rivers that is hurt by the removal of the forests but also the water supply for our cities and towns. Many of our largest cities are already beginning to find some difficulty in storing a sufficient supply of water for their use.

This preservation of the forests means also the maintenance of the water powers, which, if reduced or destroyed, will seriously injure many of our manufacturing interests.

These defects in the water supply are not due to the lack of rain but to the removal of the natural agencies that nature has provided for the storing of this water which has resulted from the removal of the forests. Again, these defects are not due to any considerable extent to the clearing of land for farming purposes for the farmer must of necessity protect the soil from being washed away and the only loss to the water supply that he would cause would be the greater evaporation to which it would be exposed. They are, however, due to the wasteful and destructive removal of the forests by the lumber companies who leave large tracts of land stript in some cases of every vestige of a tree.

The present method of cutting timber and the subsequent forest fires is causing a scarcity of lumber, especially of the hard woods, and there are now but few sections in this country where virgin forests of this character are to be found. This total destruction of a forest in lumbering is not necessary but it is a wasteful destruction of property, and a forest-covered area which should be a constant source of revenue, becomes in the end waste land and in many cases an impoverished, barren tract.

This scarcity of hard woods can be remedied by the application of practical forestry which would be adopted in any forest reserve established in the Southern Appalachian Mountains and is now being practiced in the forest reserves of the western part of this country. There is little or no doubt but that the forests of the Southern Appalachian mountains can, by systematic and conservative measures, be made to yield profitable returns to the State and country. The forests of North Carolina and Tennessee are, and have for many years, been one of the chief resources of revenue to the people of these States and thus their preservation and perpetuation means a constant source of revenue to these States.

Thus the two main and vital reasons for forest reserves are first, the protection of the water supply of our streams and

rivers; and second, the protection of our supplies of lumber, especially the hard woods.

The region that is to comprise the proposed Appalachian Forest Reserve lies for the most part in Western North Carolina and eastern Tennessee, with smaller areas in southwestern Virginia, northeastern Georgia and northwestern South Carolina. The slopes of the mountains in this region are the sources of many large rivers, as the Tennessee, the Savannah, the Broad and the Catawba. The water-power and navigation of these rivers are seriously affected by the removal of the forests in the mountainous districts as is also the water supply for the towns and cities in the vicinity of the mountains and of these rivers. This southern section of the United States has not been subjected to glacial action as the northern States have and there are, therefore, no glacial drifts in this region to act as storage reservoirs for water. Thus, in the removal of the forests we are practically removing all the natural resources for storing water.

In speaking of forest reserves and particularly of the proposed Southern Appalachian Reserve, President Roosevelt in his address at Raleigh, N. C., October 20, 1905, pointed out how vital the preservation of the forests is to the welfare of every country and that the upper altitudes of the forested mountains are most valuable to the nation as a whole, not only on account of their commercial value as supplies of lumber, but especially because of their effects upon the water supply. He further said: "Neither state or nation can afford to turn these mountains over to the unrestrained greed of those who would exploit them at the expense of the future. We cannot afford to wait longer before assuming control, in the interest of the public, of these forests; for if we do wait, the vested interests of private parties in them may become so strongly intrenched that it may be a most expensive task to oust them. If the Eastern States are wise, then from the Bay of Fundy to the Gulf we will see, within the next few years, a policy set on foot similar to that so fortunately car-

ried out in the high Sierras of the west by the national government. All the higher Appalachians should be reserved, either by the states or by the nation. I much prefer that they should be put under national control, but it is a mere truism to say that they will not be reserved either by the states or by the nation unless you people of the South show a strong interest therein."

North Carolina, which would give the largest area to the Appalachian Forest Reserve, is unequalled in its variety of hardwoods and conifers by that of any other State or Territory. Throughout the whole area of the State, the great variety of soils and climate has brought together trees from all parts of eastern America so that 24 kinds of oaks are to be found in the State, which is three more than occur in any State to the north of this one, and two more than are to be found in any State to the south; of the nine kinds of hickories known to occur in the United States, eight have been found in North Carolina; here are all six maples of the eastern United States; all the lindens; all six of the American magnolias; three of the birches; eight pines out of eleven; both species of hemlock and balsam-fir; three elms out of five; six arborescent species of plum and cherry; and three of pyrus (apple).

The bleak and exposed mountain summits, bear forests of trees which there find their southern limit, but extend northward through northern New York and New England to Canada. Such trees are the black spruce (the balsam), striped and spiked maples, mountain sumac, which is really an apple, balsam fir and aspen, all unless sheltered by other trees or by the slopes of the mountain above them, rugged and dwarfed from the cold and constant wind to which they are exposed.

The commercial forest trees are on the slopes of the mountains and in the ravines and valleys. Some of these trees have wide distribution to the north of North Carolina or to the south of it, or in both directions, and some of them are

restricted in their distribution to North Carolina or to the region around the southern Appalachian mountains.

The mossy cup, yellow and shingle oaks, white linden and big shag-bark hickory, prominent trees of the central States, extend as far to the southeast as central North Carolina; while trees of the north, like hemlock, sugar or hard maple, northern red oak, cherry, birch and white pine, and of the northeast, like the pignut hickory, chestnut, northern pitch pine and balsam enter more or less largely into the composition of the forests of the western parts of the State.

Many trees of wide distribution, and among them some of the most valuable, extend from this State in all directions, the white, post, black, scarlet and Spanish oaks, the red and white maples, the white hickory and brown heart and shag-bark hickories, short-leaf pine, yellow poplar, red cedar, black cherry, and black walnut. The cypress, water and willow oaks, downy poplar, swamp-white oak (Q. Michauxii, Nutt.) southern elm, and planer trees are trees having a great range to the south and southwest. A few trees are found only in this State, or extend but a short distance beyond its boundaries, the yellow-wood, the large-leafed umbrella tree, the Carolina hemlock, the clammy locust, the last being entirely confined to this State.

Altogether there are 153 kinds of woody plants, which form a simple upright stem and attaining arborescent proportions growing naturally within the State; and of these over seventy are trees of the first size, and fifty-seven are trees of great economic value. Fourteen of these are known to attain in this State a height of over 100 feet, three of them a height of over 140 feet, sixteen of them reach in this State diameters of five feet or over; and five reach diameters of seven feet or over.

The areas of the other States included in the proposed Forest Reserve also contain a large variety of trees and thus this region contains the greatest variety of hard woods to be

found anywhere on the American Continent for it is here that there is an intermingling of the sylva of the north and south. Here trees that are common to New England are found in close proximity to those that are common to the more Southern States. Here is the largest area of virgin forests to be found in the Southern Appalachian region. Here are trees from five to ten fieet in diameter which often tower to a height of 140 feet. The destruction of such a forest would be an almost irreparable loss, for once destroyed it would take generations for its restoration, with a great probability of failure; and then again the chances are that it would not be attempted.

These areas of timber are being rapidly acquired by those whose one object is to make the most profit possible out of them at the present time with no thought for the future. Many of the older countries, as Germany and England, have suffered to such an extent by the destruction of their forests that they, especially Germany, have begun already to take measures to preserve their forests and to make them such that they will be a constant source of lumber, and Germany has shown that by her system these forest reserves become self-supporting. England has become so depleted of her timber that she is obliged to import the greater part of her lumber.

The only remedy for the protection and preservation of our forests is for the National Government to obtain possession of them and to care for them by the application of scientific methods.

Such a forest reserve under the management of trained forest experts will demonstrate how these forests can be perpetuated and at the same time be made to pay. Such an example will have an influence on the several States and individuals by encouraging them to practice forestry and to use those lands for growing timber that are more suited for this purpose than for farming industries. It will be an object les-

son and a laboratory for those studying or interested in forestry.

The acquirement of this land by the national government for a forest reserve will not be setting a precedent for, "nearly 50,000,000 of acres of forest covered lands have been set aside (in the Western States) as National Forest Reserves and parks for the purposes of perpetuating a timber supply in the Western States and territories and for preserving forever the sources of their more important streams." Thus what is now proposed is not new either in principle or practice. There are a number of reasons that can be given why this should be a National Forest Reserve. First, the problems and dangers that it is intended to meet are national; second, this tract of land lies in several States and the streams that rise in them flow through many States and it would be difficult, even if possible, for these States to control and operate such a reserve successfully; third, these States are not so situated financially that they could even make the attempt to carry out this plan. Thus if the forest reserve such as is contemplated is established it must be done by the National Government. The several States have conferred upon Congress the necessary authority to acquire land within their respective borders. These lands can at the present time be purchased at a very reasonable price; but they are increasing in value from year to year. While there are these fifty millions of acres in National Forest Reserves and Parks in the West there is not a single National Forest Reserve in the East. (There are a few State Reserves.)

The withdrawal of this large amount of land and putting it into the hands of the Government will not prevent the development of its other resources (mineral and agricultural) for these can be developed as fast as capital desires but under the judicial guidance of the Government and it is possible for large industries to become established in them.

Besides being a forest reservation, this tract of land will also be a large National Park, though this is a secondary

consideration. It will be a National Park that will contain scenery of rare natural beauty and will contain the highest mountains east of the Rocky Mountains and which are covered with trees and shrubs to their summits. The healthfulness of this region is already known throughout the country and this and the climatic conditions are very favorable to a Park.

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WHEN GOD SAYS NO

JOHN PIPER